Title : Method for transmitting variable sized packets from an upper layer of a stack of communication protocol layers to a lower layer intended to manage fixed sized packets

SUMMARY OF THE INVENTION

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The present invention relates to a method for transmitting variable sized packets from an upper layer of a stack of communication protocol layers to a lower layer intended to manage fixed sized packets. It also relates to a packet intended to be managed by a layer of a communication protocol stack between an upper layer supporting variable sized packets and a lower layer supporting fixed sized packets. It finally relates to a method for recovering a variable sized packet from a flow of such packets.

The upper layer packets may contain data of different types, for example real time traffic data or non real time traffic data. They can be data packets, audio packets or video packets.

The upper layer traffic and lower layer traffic may be asynchronous, which means that they sometime have no data to be sent. They may also be synchronous, which means they must periodically transmit packets to its lower layer.

In order to solve the above-mentioned problem, the method according to the invention comprises the step of forming a segmentation and reassembly layer intended to manage packets, said SAR packets, made up from upper layer packets and in adding delineation information to the headers of the packets of the upper layer and the step of segmenting the thus obtained SAR packets into fixed sized packets for transmitting to the lower layer.

Note that the packets of the segmentation and reassembly layer can also be named according to a terminology used in the field of telecommunications, Segmenting and Reassembling Protocol Data Units or SAR PDU.

Preferentially, said delineation information is made up of a flag with a specific pattern.

According to another characteristic of the present invention, the header of each SAR packet is provided with a field which codes the length of the payload of said packet.

According to another characteristic of the present invention, the payload of each SAR packet is made up of the payload of one of upper layer packets.

According to another characteristic of the present invention, the header of each SAR packet is provided with a field which is a replica of the header of the upper layer packet whose payload constitutes its payload.

When the headers of the upper layer packets have different lengths depending on the characteristics of their payloads, the header of each SAR packet is provided with a field which codes the length of the upper layer packet header.

According to another characteristic of the invention, the header of each SAR packet is provided with a cyclic redundancy code applied to the whole header, the delineation information excepted.

According to another characteristic of the invention, each SAR packet is optionally provided with a cyclic redundancy code applied to the payload of said packet.

The present invention relates also to a SAR packet (or data unit) which can be managed by a segmentation and reassembly layer of a communication protocol stack which is between an upper layer intended to manage variable sized packets and a lower layer intended to manage fixed sized packets.

According to one characteristic of the present invention, that SAR packet is also a variable sized packet and is made up of a header with a delineation information and a payload which contains the payload of one of the upper layer packet. Preferentially, the delineation information is made up of a flag with a specific pattern.

The present invention also relates to a method for recovering a variable sized packet of an upper layer of a stack of communication protocol layers from a flow of packets such as those described heretofore, said method comprising the steps of:

searching in the flow of packets an delineation information and, when found, decoding a header of a found packet, then extracting the upper layer packet header, and,

pointing out a payload of the found packet, then extracting the upper layer packet payload.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing characteristics of the invention, as well as others, will appear more clearly from reading the following description of an example of embodiment of the invention, said description being made in connection with the accompanying drawings in which:

Fig. 1 is a schematic diagram showing a transmitter and a receiver with their respective layers within the scope of the present invention,

Fig. 2 is a schematic diagram showing an upper layer, a SAR layer and lower layer and their relation according to the present invention,

Fig. 3 is a schematic diagram showing the making up of a SAR packet in relation with an upper layer packet according to the present invention,

Fig. 4 is a flow chart of the synchronisation procedure carried out by the SAR layer of the invention, and

Fig. 5 is a schematic diagram showing a particular embodiment of the present invention.

Reference will now be made to Fig. 1, which shows a transmitter 10 which is linked to a receiver 20 for communication. The transmitter 10 and the receiver 20 are each represented as a protocol stack of layers each carrying out particular functions. In Fig. 1, only three layers L_{i+1}, L_i, L_{i-1} are represented. At the transmitter side, data are processed by these three layers, first by the upper layer L_{i+1}, then by the layer L_i and finally by the lower layer L_{i-1}. They are then transmitted to the receiver 20 (dash line) after complete processing in the protocol stack of the transmitter 10. At the receiver side, data are processed by the lower layer L_{i-1}, then by the layer L_i and finally by the upper layer L_{i+1}. They are then transmitted to an upper layer or to an application.

Fig. 2 shows a protocol stack comprising an upper layer L_{i+1}, a lower layer L_{i-1} and, between them, a layer L_i.

According to the present invention, in order to transmit data carried by the upper layer packets P_{i+1} to the lower layer L_{i-1}, the layer L_i build up packets P_i which are variable sized packets and which can be segmented into fixed sized packets P_{i-1} intended to be managed by the layer L_{i-1}. The thus formed layer L_i is named in the following of the present specification SAR layer, as Segmentation And Reassembly layer. The packets built up by the SAR layer are said SAR packets.

The upper layer L_{i+1} can manage packets of variable length that may support different types of traffics, for example real time (RT) traffic, non-real time (NRT) traffic, etc. In Fig. 2, a different hatching schematises each type of traffic.

According to the present invention, at the transmitter side, the SAR layer L_i builds up SAR packets P_i in adding to each packet P_{i+1} sent from the upper layer L_{i+1}, delineation information in the form of a header H_i. The header H_i of each packet P_i contains the header of one upper layer packet P_{i+1}. The payload PL_i of each packet P_i is made up of the payload of one upper layer packet P_{i+1}.

In Fig. 2, SAR packet P_i^1 is constituted of a header H_i^1 and a payload PL_i^1 which is built up from the payload of the packet P_{i+1}^1 of the upper layer L_{i+1}. Likewise, SAR packet P_i^2 is constituted of a header H_i^2 and a payload PL_i^2 which is built up

from the payload of the packet P_{i+1}^2 of the upper layer L_{i+1}. It is the same for SAR packets P_i^3 et P_i^4.

The SAR layer L_i also segments the stream of the thus formed packets P_i into a stream of fixed length packets P_{i-1} that are then sent to the lower layer L_{i-1}.

When there is not enough data to complete the packet of the lower layer L_{i-1}, the layer L_i, if needed, adds idle information to build up the fixed sized packet of layer L_{i-1}. As it will be explained hereinafter, idle data can be made up of any type of data, the flag pattern preferentially excepted.

8 DETAILED DESCRIPTION

As it can be seen in Fig. 2, there are no alignments between SAR packets P_i and lower layer packet P_{i-1}. In Fig. 2, the packet P_{i-1}^1 is made up of a part from the packet P_i^1, of the whole packet P_i^2 and another part from the packet P_i^3. The packet P_{i-1}^2 is made up of the rest of the packet P_i^3 and of idle data. The packet P_{i-1}^3 is made up of idle data and of whole the packet P_i^4.

Note that the Layer L_{i-1} has no information concerning the frame structure that is used by the upper layer L_{i+1}.

Fig. 3 points out the different fields that compose a SAR packet P_i with regard to an upper layer packet P_{i+1}. The payload PL_i of the packet P_i is a replica of the payload PL_{i+1} of the packet P_{i+1} of the upper layer L_{i+1}.

The header H_i contains a flag field F for use to delineate the SAR packet P_i and thus to mark its beginning. The flag field F is formed of a specific pattern, for example a 8 bits pattern such 0xA5 pattern.

The header H_i still contains a field which is the replica of the header H_{i+1} of the upper layer packet P_{i+1} used to build up the SAR packet P_i.

Many types of upper layer header H_{i+1} can be generated by the upper layer L_{i+1} which each can be characterised by a specific length of the header H_{i+1}. In this case, the SAR layer header H_i can be provided with a header identification field HID which defines either the type or the length of the upper layer header H_{i+1}. In the first case, the length of the header H_{i+1} field can be deduced from the type coded by the HID field.

The length of the payload of the SAR packet is coded in a length field LEN.

A CRC1 field is added for detecting bit errors in the HID field, in the header field H_{i+1} and in the LEN field can be added. It can be a Cyclic Redundancy Code applied to these fields.

A second CRC2 field for detecting if the payload of the SAR packet has been corrupted during transmission can be added.

At the receiver side, layer L_{i-1} packets are transmitted to the SAR layer L_i. In order to get the receiver synchronised with the flow of SAR packets P_i, the receiver has to search the delineation information of a packet P_i and, when found, to decode successfully the remaining part of the SAR header H_i. Then, it has to point the first byte of the payload PL_i. The synchronisation process is now described in relation with Fig. 4, which is a flow chart of the synchronisation procedure.

A flag F is first searched amongst the data that have been received from the lower layer L_{i-1}. When the flag F has been found, the HID field is read and the length of the header H_{i+1} is determined.

If the value contained in the HID field does not correspond to a known value, that means that the flag reading step or the HID reading step are erroneous. Therefore, the flag F is again searched.

After a correct header H_{i+1} has been read, the length field LEN is read so as to determine the length of the SAR payload PL_i.

The content of the CRC1 field is then checked so as to detect whether or not errors have occurred during the SAR header H_i reading. If the result of this process is correct, the synchronisation process is over. Then, the reading of the SAR payload PL_i can start. If the result is negative, a new flag F searching restarts the synchronisation process.

Note that no mechanism is implemented during transmission to ensure the flag field F does not appear in the SAR payload PL_i. Therefore, when flag F is detected, when the value in the HID field is one of a known type and when the CRC1 reading and checking process returns no error detection, there is enough confidence that it is the start of a SAR packet P_i.

Note that no particular pattern is required for defining idle data.

Fig. 5 illustrates the implementation of the invention in the case where the lower layer corresponds to an ADSL layer and the upper layer to an ARQ layer. The layer above the ARQ layer is an ATM layer. The ATM layer is intended to bear ATM cells, which are generally composed of 48 bytes for the payload and 5 bytes for the header.

In Fig. 5, the cells C_1, C_2, C_3 and C_6 are ATM cells of one same type, for example non real time cells type and the cells C_4, C_5, C_7, C_8 and C_9 are also ATM cells of another same type, for example real time cells type. The ATM traffic is asynchronous and can be bursty.

The ARQ layer is the layer that builds up ARQ packets from ATM cells when transmitting, extracts ATM cells from ARQ packets when receiving, and manages ARQ packets when lost. Each ARQ packet groups ATM cells of a same type, for example real time or non real time ATM cells, and has a header which is provided to identify the ATM cells type. The length of this header can depend on the type which cells belong to.

The ARQ layer has to manage real or non real time ATM traffic, which implies that ARQ packet length is variable.

In Fig. 5, the cells C_1, C_2, C_3 and C_6 are encapsulated in a same first packet P^1_{ARQ} and the cells C_4, C_5, C_7, C_8 and C_9 are encapsulated in a same second packet P^2_{ARQ}.

According to the method of the present invention, the SAR layer builds up SAR packets P^1_{SAR} and P^2_{SAR} and segments them into the ADSL layer, where only one packet P^1_{ADSL} is representated.

The ADSL layer can be synchronous and or asynchronous.